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Running head: STEREOTYPE LIFT IN MOTOR PERFORMANCE

**Investigating Physiological and Self-Reported Mediators of Stereotype Lift Effects  
on a Motor Task**

Aïna Chalabaev

University of Grenoble 1, France

Jeff Stone

University of Arizona

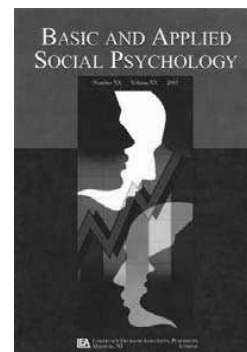
Philippe Sarrazin

University of Grenoble 1, France

Jean-Claude Croizet

University of Poitiers, France

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Correspondence concerning this article should be addressed to Philippe Sarrazin, Laboratoire Sport et Environnement Social, Université Joseph Fourier - UFRAPS, BP53, 38041 Grenoble cedex 9, France.

+33 475.78.15.52 (voice); +33 475.78.15.50 (fax). E-mail: philippe.sarrazin@ujf-grenoble.fr

### Abstract

Achievement gaps between social groups may result from stereotype threat effects but also from stereotype lift effects – the performance boost caused by the awareness that an outgroup is negatively stereotyped. We examined stereotype lift and threat effects in the motor domain and investigated their mediation by task involvement and self-confidence. Physiological (heart rate reactivity) and self-reported indices were used to examine these questions. Males and females performed a balance task about which negative stereotypes about either males or females were given. No gender information was given in a third (control) condition. Results showed no stereotype threat but a stereotype lift effect, participants performing significantly better after negative outgroup stereotypes were explicitly linked to performance on the balance task compared to the other conditions. Concerning males, this effect was mediated by higher self-confidence and task involvement. The implications of these results for understanding the gender inequalities in sports and physical activities are discussed.

Keywords: stereotype lift; stereotype threat; gender; motor performance; heart rate reactivity; self-confidence.

## Investigating Physiological and Self-Reported Mediators of Stereotype Lift Effects on a Motor Task

Recent research on understanding the roots of social inequalities has focused on the consequences of stereotypes for their targets (e.g., Swim & Stangor, 1998). Being the target of negative stereotypes has been shown to influence the academic choices (Eccles, 1994), self-esteem (e.g., Crocker & Major, 1989) and task performance outcomes of stigmatized groups (e.g., Steele & Aronson, 1995). With respect to task performance outcomes, the *stereotype threat* theory (Steele, 1997) states that when a negative stereotype about a group's ability is made relevant in a test-taking situation, target individuals may fear being evaluated based on the stereotype. This evaluative threat creates an extra pressure that hampers their performance. Many studies now show evidence for the stereotype threat prediction primarily in the domain of academic test performance (see Steele, Spencer & Aronson, 2002; Smith, 2004 for reviews).

Other studies suggest that stereotype threat is not the only process by which stereotypes can lead to social inequalities in achievement. While having a deleterious effect on their targets, negative stereotypes may also cause inequities by improving the performance of individuals not targeted by the negative stereotypes—a phenomenon called *stereotype lift* (Walton & Cohen, 2003). Evidence of stereotype lift effects has appeared for non-stereotyped targets used as control participants in many studies that documented stereotype threat. Specifically, stereotype lift effects occur when non-stereotyped participants perform better after a negative stereotype about an outgroup is made salient compared to when it is not made salient (e.g., Croizet, et al., 2004; Spencer, Steele & Quinn, 1999; Steele & Aronson, 1995; see Walton & Cohen, 2003 for a meta-analysis). To explain the stereotype lift effect, Walton and Cohen (2003) suggested that negative outgroup stereotypes exert their impact by encouraging downward social comparisons with a denigrated outgroup (e.g., Fein & Spencer,

1997). When comparing themselves with a socially devalued outgroup, people may experience an elevation in their self-confidence and motivation to succeed, which may, in turn, improve their performance. At this writing, no work has yet provided support for these assumptions about what mediates stereotype lift. The current study was designed to examine stereotype lift and threat effects with a particular focus on potential mediators of the process by which negative stereotypes can enhance or decrease performance of individuals.

### The Mediational Processes of Stereotype Lift and Threat Effects

Although much more research has investigated how stereotype threat exerts its deleterious effect on performance, the evidence of what mediates this effect is mixed. For example, some studies have found a partial mediation of stereotype threat by anxiety (e.g., Spencer et al., 1999), performance expectations (e.g., Cadinu, Maass, Frigerio, Impagliazzo & Latinotti, 2003) and self-handicapping strategies (e.g., Keller, 2002), but no one construct has emerged as a strong reliable mediator. One reason for the paucity of data is that many studies used only self-report methods to capture negative affective states or cognitions. There are at least two potential limitations to this approach. First, participants may be concerned with self-presentation strategies and motivated to appear invulnerable to stereotypes (e.g., Bosson, Haymovitz & Pinel, 2004). Second, stereotype threat processes may be unconscious (e.g., Croizet & Claire, 1998), so that participants may not be able to accurately report the proposed mediational construct.

Recent studies have attempted to overcome these limitations by using indirect measures to capture the mediators of stereotype threat. For example, Schmader and Johns (2003) used a dual-processing task to show that stereotype threat was mediated by a reduction in working memory capacity and Bosson and colleagues (2004) reported that stereotype threat was mediated by non-verbal anxiety behaviors. Physiological indices of threat have also been used as indirect measures. Some studies showed that a threatening situation may

increase blood pressure (Blascovich, Spencer, Steele & Quinn, 2001; Scheepers & Ellemers, 2005) and Croizet and colleagues (2004) showed that stereotype threat effects were mediated by increased cognitive load assessed by heart rate (HR) variability. Their covert and pre-conscious nature makes physiological indices especially useful for measuring how people respond to the salience of negative stereotypes in a performance situation.

The current study examined whether stereotype lift and threat effects would also manifest themselves through physiological indices, more particularly HR responses. An increase in HR has been interpreted in previous studies as indicating greater effort (Wright & Kirby, 2001) or task engagement – psychological involvement in a task produced by striving toward a self-relevant goal – (for a detailed description of the relationship between HR and effort/engagement, see Blascovich & Tomaka, 1996; Wright & Kirby, 2001), both referring to the idea of involvement in the task. HR reactivity appears thus as particularly relevant to test the assumptions of Walton & Cohen (2002) relative to the role of task engagement in the mediation of stereotype lift. Furthermore, this index may also mediate stereotype threat as previous studies showed that threatened individuals may reduce their effort as a self-handicapping strategy for coping with stereotype threat (Stone, 2002).

Using physiological mediators of stereotype lift and threat permits triangulation on multiple mediators when collected with self-report measures of self-confidence and anxiety. Thus, this study used both physiological and self-reported indices to investigate the mediators of stereotype lift and threat effects.

### Gender Stereotypes and Motor Performance

Another contribution of the current study was to document stereotype lift and threat effects in the context of examining gender differences in motor performance. Gender inequities in motor performance, especially in the domain of sport, are well documented. Indeed, studies showed that males are superior to females in many motor tasks, especially

those that involve strength or speed (e.g., Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2002; Eccles & Harold, 1991; Thomas & French, 1985). Although gender inequalities in sports are commonly thought to be the result of biological differences, they may also be caused by the social expectancies and self-beliefs related to stereotype processes. Previous research indicates that sports and physical activities are considered as a masculine domain in western countries (e.g., Czisma, Wittig, & Schurr, 1988; Koivula, 1999; Riemer & Visio, 2003). Thus, examining gender differences in motor performance from a stereotype influence perspective may provide new insights into the phenomena (Stone & McWhinnie, 2005).

Previous studies on stereotype threat in sports have documented racial differences in performance when racial stereotypes were made salient while performing a golf-putting task (Stone, 2002; Stone, Lynch, Sjomeling & Darley, 1999). However stereotype lift has never been demonstrated in the athletic domain. Given that it is not clear whether stereotype effects are the same on cognitive and motor performance (Beilock & McConnell, 2004), more studies are needed in this area to investigate the pervasiveness of stereotype lift across domains.

### The Present Research

The goals of the current research were (1) to examine stereotype lift and threat effects on the motor performance of male and female targets, and (2) to measure both self-report and physiological mediational processes of these effects. Although many sports are traditionally classified as inappropriate for women (e.g., boxing), others are considered as inappropriate for men (e.g., dancing) (e.g., Koivula, 1999). Thus, we were interested in comparing targets' reactions when negative stereotypes about males and females were salient during a novel motor performance, in this case, a balance task. It was hypothesized that negative stereotypes about males and females could be activated with a balance task insofar as it belongs to the motor domain and is thus related to sports. Many studies reported the existence of shared

stereotypes according to which “masculine” sports are those requiring strong athletic abilities and “feminine” sports are those requiring fine and precise motor skills (e.g., Ignico, 1989; Riemer & Visio, 2003). Thus, the poor ability of females on this task could be attributed to the common belief that women have less athletic ability than men, and the poor ability of males could be attributed to the belief about the poor movement finesse of men. Performing a balance task is then a stereotype-relevant context in which both stereotype lift and threat may occur.

In order to investigate stereotype lift and threat processes, gender stereotypes were activated in an explicit manner; that is, male and female participants were told that either males or females are well known to perform poorly on the balance task. We reasoned that in order for stereotype lift to occur on a novel task, targets could not be expected to infer that their group is superior to another group. The processes assumed to underlie stereotype lift, such as downward social comparison and enhanced feelings of self-confidence, would be more systematically activated if participants were told about the outgroup's inferiority on the task.

In accordance with stereotype lift theory, it was predicted that targets would perform better on the balance task when they were told that an outgroup was known to perform poorly on the task as compared to when they were not provided with group-performance information. This stereotype lift effect would be mediated by higher self-reported self-confidence and task involvement indicated by an increase in HR<sup>1</sup> (e.g., Wright & Kirby, 2001). In accordance with stereotype threat theory, it was predicted that targets would perform lower on the balance task when they were told that their ingroup was known to perform poorly on the task as compared to when they were not provided with group-performance information. This stereotype threat effect would be mediated by lower self-



reported self-confidence, higher self-reported anxiety and lower task involvement indicated by a decrease in HR.

## Method

### *Participants and Design*

Participants were 66 undergraduate students (33 males and 33 females) enrolled in the sport sciences program at the University of Grenoble (France). They participated in a 2 (sex: males vs. females) X 3 (test frame manipulation: males inferior vs. females inferior vs. no-information control) between-subjects design. These students were recruited on a voluntary basis by announcements made during sport psychology classes. The data of three participants (one male and two females) were discarded because of technical problems with the stabilometer, leaving thirty-two males and thirty-one females in this experiment.

### *Procedure*

Participants completed the procedures individually. The experimenter explained to them that they would complete some questionnaires and perform a motor test of balance. A cardio frequency meter was then attached to the participants' chest, who were asked to relax for a few seconds while their baseline HR was recorded.

Then participants were assigned to one of three test frame conditions. Two conditions involved the activation of a blatant negative stereotype by emphasizing the poor balance ability of males or females. In the "males inferior" ("females inferior") condition, participants were told that: "The goal of this experiment is to compare balance in males and females (females and males). Previous studies showed that males (females) have problems keeping their balance compared to females (males), and we are trying to understand why they have these difficulties". After the instructions, participants watched videotape showing a female (male) performing the motor task very well for five seconds.

In the control condition, participants were told that: “We are trying to understand the psychological and physiological processes involved in performance on this task”. After the instructions, participants watched the two videotapes watched in the two other conditions.

Then participants completed a pre-performance questionnaire packet that contained a manipulation check and the pre-competitive state anxiety and confidence scales. Thirty seconds prior to the beginning of the test, the experimenter started the cardio frequency meter recording HR continuously. After participants completed the motor test they were fully debriefed.

### *Dependent measures*

#### *Manipulation check*

Participants were asked to indicate on a 1 (strongly disagree) to 7 (strongly agree) scale whether “generally, females perform higher than males” and whether “generally, males perform higher than females”. A difference score was computed by subtracting the male inferior score from the female inferior score such that a positive value would indicate that females were perceived as performing better than males, and a negative value would indicate that males were perceived as performing better than females. The order of these two items was counterbalanced.

#### *Athletic performance test*

The task was a stabilometer motor task that requires participants to maintain their balance in a standing position on a platform rotating around a central pivoting shaft. Participants began the task with one side of the platform touching the floor. The goal was to maintain balance as long as possible on the platform. Time in balance was defined as the time during which the platform did not touch the floor and was automatically measured with a stopwatch linked to the stabilometer by an electrical system. Each time the platform touched the floor, participants were asked to start another trial, with the platform putting down on the

floor. The test period lasted four minutes and the performance score corresponded to the mean time of the three best trials.

#### *State anxiety and self-confidence*

The Revised Competitive State Anxiety Inventory-2 (R-CSAI-2, Cox, Martens, & Russell, 2003) was administered to the participants. This inventory is composed of three subscales measuring self-confidence, somatic and cognitive anxiety. Seven items measured somatic anxiety (e.g., “I feel tense in my stomach”). Five items measured cognitive anxiety (e.g., “I am concerned about performing poorly”) and five items measured self-confidence (e.g., “I am confident about performing well”). Participants responded on a 1 (not at all) to 7 (very much) scale.

#### *Heart Rate*

HR was recorded with an ambulatory device (cardio frequency meter Polar s610i, Polar Electro Oy, Finland, 2000). The Polar 610i is a lightweight instrument strapped on a belt linked to the participant by three electrodes on the chest. It is equipped with a microprocessor that measures the time lapse between two heartbeats with millisecond precision. The data were recorded by the Precision Performance Polar 3.02.007 program (Polar Electro Oy, Finland, 2001) that stored every five seconds the mean HR of the last five seconds. In the next analyses HR was taken into account at six different times in addition to the baseline value: thirty seconds before the beginning of the test period, when the test began and at each minute of the test.

### Results

#### *Preliminary Analyses*

Before testing the primary hypotheses, we examined whether participants correctly perceived the gender differences on the task. A 2 (sex) X 3 (test frame manipulation) between-subjects analysis of variance (ANOVA) showed only a significant main effect of the

test frame manipulation on the perceived gender difference score,  $F(2, 57) = 235.97, p < .001$ . Comparisons showed that females were perceived as performing higher than males in the males inferior condition ( $M = -4.82, SD = 0.33$ ) compared to the control condition ( $M = 0.05, SD = 0.36$ ),  $F(1, 57) = 99.78, p < .001$ . Moreover, males were perceived as performing higher than females in the females inferior condition ( $M = 5.36, SD = 0.33$ ) compared to the control condition,  $F(1, 57) = 118.89, p < .001$ . Thus, the data indicated that the manipulations had the intended effects on the perceived gender differences on the task.

Individuals may be susceptible to stereotype effects only when the task is self-relevant, and the self-relevance of a task may be reflected by task engagement (e.g., Blascovich, Seery, Mugridge, Norris & Weisbuch, 2004). We thus confirmed that participants were engaged in the task by testing against zero HR reactivity scores computed by subtracting the baseline resting value from the pre-performance value (e.g., Blascovich et al., 2004). Only pre-performance HR was examined because an HR increase during the task may indicate engagement but also the metabolic demands of the task. Results showed that pre-performance HR increases were significantly greater than zero in the three conditions ( $ts > 4.37, ps < .001$ ), indicating that participants were engaged thirty seconds before the task begins.

### *Balance Performance*

The means of performance and the potential mediators according to sex and test frame manipulation are reported in Table 1.

In order to test the primary hypotheses, a 2 (sex) X 3 (test frame manipulation) ANOVA was performed on the measure of balance performance. The results showed only a significant sex-by-test frame manipulation interaction effect,  $F(2, 57) = 3.43, p = .04, \eta^2 = .11$ . Within-gender comparisons across conditions showed that males in the females inferior condition tended to perform higher ( $M = 24.26$ ) than in the control condition ( $M = 9.87$ ),  $F$

(1, 57) = 3.67,  $p = .06$ , although this difference did not reach significance. However, males in the males inferior condition ( $M = 11.96$ ) did not perform significantly lower than in the control condition,  $F(1, 57) = .07$ ,  $ns$ . Results also showed that females in the males inferior condition performed significantly higher ( $M = 29.81$ ) than in the control condition ( $M = 11.62$ ),  $F(1, 57) = 5.54$ ,  $p = .02$ . However, females in the females inferior condition ( $M = 15.07$ ) did not perform lower than in the control condition,  $F(1, 57) = .20$ ,  $ns$ . Thus, both males and females showed a stereotype lift effect when the balance task was framed as a measure of a negative outgroup stereotype but no stereotype threat effect when the balance task was framed as a measure of a negative ingroup stereotype.

### *Self-Confidence*

The internal reliability of the self-confidence subscale was satisfactory ( $\alpha = .74$ ). We then combined the items to create an index that was subjected to the ANOVA analysis. A significant sex-by-test frame manipulation interaction effect on self-confidence was found,  $F(2, 57) = 3.66$ ,  $p = .03$ ,  $\eta^2 = .11$ . Within-gender comparisons showed that males were more self-confident in the females inferior condition ( $M = 3.95$ ) than in the control condition ( $M = 3.18$ ),  $F(1, 57) = 4.06$ ,  $p = .05$ . However, males were not less self-confident in the males inferior condition ( $M = 3.07$ ) than in the control condition,  $F(1, 57) = .08$ ,  $ns$ . Self-confidence of females was not different across conditions ( $F_s < 1$ ), meaning that the test frame manipulation did not influence the self-confidence of females.

### *Anxiety*

The internal reliability of the somatic anxiety ( $\alpha = .89$ ) and cognitive anxiety ( $\alpha = .87$ ) subscales was satisfactory. We then combined the items to create two indices which were subjected to the ANOVA analysis. No main or interactive effects were found on the somatic and cognitive anxiety ( $F_s < 1$ ), meaning that the test frame manipulation did not influence these variables.

### *Physiological Activity*

#### *Preliminary Analyses*

The 2 X 3 ANOVA showed no main or interactive effects of sex and test frame manipulation on baseline HR,  $F_s < 1.21$ , *ns*. Reactivity scores were then computed for each time interval (e.g., Blascovich et al., 2001; Croizet et al., 2004).

#### *HR Reactivity*

Given that HR during the task may indicate not only engagement but also the physical exertion required by the task, significant interaction effects were expected primarily on pre-performance HR reactivity. We then performed separate ANCOVA analyses for each HR reactivity score with baseline HR as a covariate to further control for relative baseline levels. The analyses revealed a significant sex-by-test frame manipulation interaction effect on pre-performance HR reactivity,  $F(2, 56) = 3.66$ ,  $p = .03$ ,  $\eta^2 = .10$ . Within-gender comparisons showed that the pre-performance HR reactivity of males tended to be significantly higher in the females inferior condition ( $AjM = 18.77$ ) than in the control condition ( $AjM = 10.18$ ),  $F(1, 56) = 3.52$ ,  $p = .06$ . Pre-performance HR reactivity of males in the males inferior condition ( $AjM = 6.82$ ) was not lower than in the control condition,  $F < 1$ . Results also showed that the pre-performance HR reactivity of females tended to be higher in the males inferior condition ( $AjM = 15.75$ ) than in the control condition ( $AjM = 7.84$ ),  $F(1, 56) = 2.77$ ,  $p = .10$ , although this trend was not significant, and that pre-performance HR reactivity of females in the females inferior condition ( $AjM = 10.84$ ) was not lower than in the control condition,  $F < 1$ .

In addition, no other effects were found on the other time intervals, meaning that the test frame manipulation did not affect HR reactivity of participants while performing the test.

#### *Mediational Analyses*

The previous analyses showed that although the test frame manipulation affected identically the performance of males and females, it affected the self-confidence and pre-performance HR reactivity of males only. To examine whether these two variables mediated the stereotype lift effect for males, we compared the self-confidence and pre-performance HR reactivity of males in the lift and control conditions using contrast coding. Specifically, we assigned codes of 1, 0 and -1 to males in the females inferior, males inferior and control conditions respectively. The intercorrelations between the variables for males and females are indicated in Table 2. To further control for relative baseline levels we regressed pre-performance HR reactivity score onto its baseline value and we took into account this residual in the subsequent analyses.

Several regression analyses were performed following the procedure advocated by Baron and Kenny (1986). As depicted in Figure 2, the test frame manipulation significantly predicted self-confidence ( $\beta = .35, p < .05$ ) and tended to predict pre-performance HR reactivity ( $\beta = .31, p = .08$ ), showing that males in the lift condition were more self-confident and tended to be more involved before the beginning of the task compared to the two other conditions. More importantly, when the potential mediators and the test frame manipulation were included in the same equation, the direct pathway from the test frame manipulation to performance ( $\beta = .39, p = .03$ ) dropped to nonsignificance ( $\beta = .15, ns$ ) whereas the effects of self-confidence and HR on performance were significant ( $\beta = .33, p = .04$  and  $\beta = .39, p = .02$ , respectively). These results showed that self-confidence and pre-performance HR reactivity mediated independently the test frame manipulation – performance relationship.<sup>2</sup>

### Discussion

This research was aimed to study stereotype lift and threat effects in a context of motor performance and to examine physiological and self-reported mediators of these effects.

The analyses of the balance performance data revealed the predicted stereotype lift effect: Males and females performed significantly better after negative outgroup stereotypes were explicitly linked to performance on the balance task compared to when negative stereotypes were not made salient (e.g., Croizet et al., 2004; Spencer et al., 1999). The data support the hypothesis that stereotype lift can emerge when non-targets are provided with explicit downward social comparison information about another group's performance on the task. They provide an important extension of previous research by demonstrating significant stereotype lift effect on a nonacademic motor task with both males and females.

Another unique finding in the current data is the evidence of processes that mediate stereotype lift. Among males, the stereotype lift effect was mediated by their involvement in the task and by their level of self-confidence. The data suggest that the explicit downward comparison with a devalued outgroup improved males' self-confidence and task involvement, and these variables contributed to the observed performance boost. Although this study supports the main assumptions of Walton and Cohen (2003), the gender difference in mediation was not expected. It is possible that the activated stereotypes about males and females were different in accessibility. Given that motor performance is a male-oriented domain (e.g., Koivula, 1999), the belief that women have less athletic ability than men may be more accessible than the belief about the poor movement finesse of men. The difficulty for females to rely on a strong stereotype could explain why they were not more self-confident and involved in the task in the males inferior condition. Future research is necessary to uncover the processes that mediated the lift effect observed for females in the current research.

It is also important to note that the mediation of stereotype lift for males occurred before the beginning of the task. Indeed self-confidence was measured a few minutes before the task and only pre-performance HR reactivity mediated the performance. This is consistent



with research by Stone (2002), who noted that stereotype threat might start its detrimental effects in the days, hours or minutes prior to the critical performance. Thus, Stone (2002) showed that threatened participants coped with the potential threat by engaging in proactive defensive reactions like behavioral self-handicapping before their performance began. Our results suggest that the possibility of outperforming another group may also be anticipated and begin once the negative stereotype about the outgroup is linked to the upcoming performance. The extra self-confidence and energy mobilization may have prepared the organism to meet expected task demands, enabling participants to be immediately efficient while performing the task (e.g., Wright, Contrada & Patane, 1986). Nevertheless, as noted earlier, when measured during the task, the cardiac response may have indicated not only involvement in the task but also other variables like the physical exertion required by the task to maintain balance. This unclear meaning of HR did not allow us to examine the mediating role of task involvement during the task. Whereas the current data indicate that stereotype lift is mediated by increased self-confidence and task involvement before the performance begins, the processes that mediate stereotype lift during the task are still unknown.

Are our findings evidence for what Shih and colleagues called the stereotype susceptibility effect (Shih, Pittinsky & Ambady, 1999), defined as the performance boost caused by activation of a *positive* ingroup stereotype? In contrast to stereotype susceptibility, stereotype lift is triggered by a negative outgroup stereotype. In other words, whereas stereotype susceptibility focuses on groups targeted by positive stereotypes, stereotype lift focuses on groups that are non-stereotyped (Walton & Cohen, 2003). In this study, the instructions emphasized the poor ability of one particular group (thus activating a *negative* stereotype), suggesting that the ability of the other group was normal and not particularly high on the balance dimension. Thus the findings offer more support for the stereotype lift than for the stereotype susceptibility hypothesis.<sup>3</sup> This distinction is important because

activating a negative outgroup stereotype implies ingroup advantage indirectly rather than directly (Walton & Cohen, 2003). This activation is thus unlikely to threaten performance by creating concern about failure to meet high expectations held for one's group – phenomenon known as “choking under pressure” – as it may sometimes occur when positive ingroup stereotypes are activated (Cheryan & Bodenhausen, 2000; Smith & Johnson, 2006).

Finally, this study reported no stereotype threat effect. One explanation is that the balance task was not perceived as a difficult test. Previous research has shown that the salience of negative stereotypes is more likely to impact performance when the task is difficult (e.g., O'Brien & Crandall, 2003). It is possible that the act of balancing is not sufficiently challenging to induce the processes that underlie stereotype threat responses. However, that a lift effect did emerge suggests that perhaps threat and lift responses are asymmetrically related to each other. That is, people may experience enhanced confidence and task engagement, and perform better, when positive stereotypes are salient, regardless of the difficulty of the task. No prior research has examined the role of task difficulty in stereotype lift effects and this will be a fruitful direction for future research.

Another possible explanation of this absence of stereotype threat is *stereotype reactance* – an engagement in behaviors that are counter to those prescribed by the stereotype. Based on the *psychological reactance* theory (Brehm, 1966), the stereotype reactance theory (Kray et al., 2001) states that reactance occurs when people perceive limitations to their ability to perform, in this case when negative ingroup stereotypes are linked to performance on a task. Kray and colleagues suggested that what differentiates an engagement in threat or reactance behaviors is the nature of the activation of stereotypes. When a negative ingroup stereotype is *explicitly* linked to performance on a task, people become aware of the stereotype and may try to defeat it. Although the performance of participants when the negative ingroup stereotype was explicitly linked to their performance

did not significantly differ from that of the control condition, it tended to be higher. The explicit statement about the poor performance of their group on the balance task may have motivated participants to try to defeat the negative characterization. Their performance did not significantly differ from that of the control condition maybe because some participants responded to the explicit negative stereotype with threat whereas others responded with reactance. This suggests that there may be individual difference variables, like self-engagement in the performance domain (Stone, 2002; Stone et al. 1999) social anxiety or self-confidence, that determines whether people feel threatened or challenged when confronted with a negative explicit stereotype about their group. We performed follow-up analyses to examine whether the relationship between the activation of a negative ingroup stereotype and performance was moderated by pre-performance heart rate reactivity, anxiety or self-confidence, but these analyses did not show any significant interactions. Investigating personal and contextual factors that distinguish threat and challenge responses when explicit negative stereotypes are linked to performance represents an important direction for future research.

Whereas the nature of stereotype activation (explicit vs. implicit) may moderate stereotype threat effects, Walton and Cohen (2003) reported that it should not moderate stereotype lift effects. This could offer another explanation for why only stereotype lift effects were found in this study.

To conclude, this study supports the idea that situations activating gender stereotypes may induce gender differences in achievement, and that the gender appropriateness of motor tasks may be socially constructed. More importantly, this research shows that these differences are not only due to the debilitating effects of stereotype threat but also to the performance boosts of stereotype lift. This could suggest one way in which stigmatized individuals are doubly handicapped by stereotypes: even if they managed to cope with a

threatening stereotype, they may still underperform relative to non-stereotyped targets who can experience a performance boost. In the sports area where many activities are sex-typed, the gender gaps existing in achievement and motivation can be the result of the activation of gender stereotypes.

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## Footnotes

1. Blood pressure (BP) indexes were also collected along with HR. However the meaning of BP is unclear, interpreted as an indicator of threat in some studies (e.g., Blascovich et al., 2001) and effort in others (e.g., Wright & Kirby, 2001). Moreover the analyses showed no effect of test frame manipulation on BP indexes, so they were dropped from this study.

2. When self-confidence and pre-performance heart rate reactivity were included in separate analyses, they both significantly predicted performance ( $\beta = .38, p = .03$  and  $\beta = .44, p = .01$ , respectively), whereas the relationship between test frame manipulation and performance was not significant ( $\beta = .26, ns$  for both analyses).

3. As suggested by an anonymous reviewer, examining the correlation between each manipulation check item and the performance of subjects placed in the lift conditions could shed light on whether the boost effect derives from negative stereotypes about the outgroup, or positive stereotypes about the ingroup. That is, performance in the lift condition might correlate better with the item assessing negative expectancies about the outgroup than positive expectancies about the ingroup. Unfortunately, the correlations were non significant, probably because the samples were too small ( $n = 11$  in both lift conditions).

Table 1.

*Means of Performance and the Potential Mediators According to Sex and Test Frame Manipulation.*

Sex and variable	Test frame manipulation		
	Males inferior	Females inferior	Control
<b>Males</b>			
Performance	11.96	24.26	9.87
Self-confidence	3.07	3.95	3.18
Cognitive anxiety	2.24	2.87	2.84
Somatic anxiety	1.74	2.40	2.59
Pre-performance HR	6.82	18.77	10.18
Mean HR during test	34.05	44.81	39.38
<b>Females</b>			
Performance	29.81	15.07	11.62
Self-confidence	3.35	2.89	3.24
Cognitive anxiety	2.83	2.60	2.40
Somatic anxiety	1.94	2.21	1.70
Pre-performance HR	15.75	10.84	7.84
Mean HR during test	39.89	42.54	35.31

*Note.* Pre-performance HR and mean HR during test are covariance-adjusted for mean baseline.

Table 2.

*Intercorrelations Between the Variables for Males and Females*

Variable	1	2	3	4	5	6	7
1. Test frame manipulation	-	0.38*	0.16	0.14	-0.02	0.23	0.00
2. Performance	0.42*	-	0.16	-0.02	-0.13	0.16	0.08
3. Self-confidence	0.44*	0.48**	-	-0.39*	-0.31	0.07	0.19
4. Cognitive anxiety	0.12	-0.15	-0.03	-	0.69***	-0.22	0.20
5. Somatic anxiety	0.11	-0.22	-0.12	0.59***	-	-0.05	0.30
6. Pre-performance HR	0.45*	0.52**	0.23	-0.14	-0.16	-	0.31
7. Mean HR during test	0.33	0.23	0.01	0.36*	0.25	0.24	-

*Note.* The correlations for males ( $n = 32$ ) are below the diagonal, the correlations for females ( $n = 31$ ) are above the diagonal.

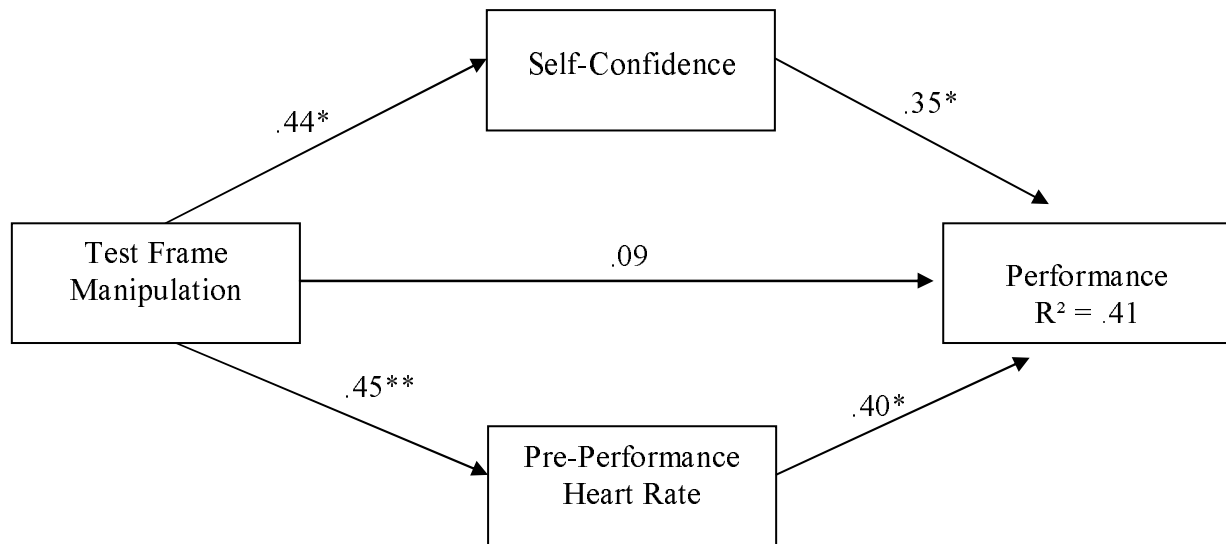
Physiological indices are the residuals of the reactivity scores regressed onto their baseline values. Test frame manipulation was coded as follows for males: -1: males inferior and control conditions; 2: females inferior condition, and as follows for females: -1: females inferior and control conditions; 2: males inferior condition.

\*  $p < .05$ . \*\* $p < .01$ .

Figure Captions

*Figure 1.* Mediation of stereotype lift effect by self-confidence and heart rate reactivity for males.

Figure 1.



*Note.* The regression coefficient from the test frame manipulation to performance represents the effect of the test frame manipulation after controlling for the effect of the mediators. Test frame manipulation was coded as follows: -1: males inferior and control conditions; 2: females inferior condition. Pre-performance Heart Rate is the residual of the pre-performance HR reactivity score when regressed onto HR baseline value.

\*  $p < .05$ , \*\*  $p < .01$